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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/801,981	03/16/2004	Diane K. Stewart	F118ACIP	2497

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MICHAEL O. SCHEINBERG
P.O. BOX 164140
AUSTIN, TX 78716-4140

EXAMINER	
SOUW, BERNARD E	

ART UNIT	PAPER NUMBER
2881	

DATE MAILED: 03/17/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/801,981	STEWART ET AL.	
	Examiner	Art Unit	
	Bernard E. Souw	2881	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *16 March 2004*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-26* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-26* is/are rejected.

7)☒ Claim(s) *11,12 and 24* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *16 March 2004* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date *6/14/04 + 1/31/05*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Specification

1. The lengthy specification has not been checked to the extent necessary to determine the presence of all possible minor errors. Applicant's cooperation is requested in correcting any errors of which applicant may become aware in the specification.

Objection of the Claims

2. Claim 11 and 12 are objected to because of the following informalities: The expression "*10-3 Torr*" is misprinted. Appropriate correction is required.

To proceed with this office action, the pressure is understood by the examiner as "10^{-3} *Torr*".

3. Claim 24 is objected to because of the following informalities: The wording "*electrically isolated from one another*" is grammatically incorrect. Appropriate correction is required.

To proceed with this office action, the objected wording is understood by the examiner as "*electrically isolated* ***from one to another***", or "*electrically isolated* ***one from another***".

Claim Rejections - 35 USC § 112

The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

4. Regarding claims 13 and 14, the phrase "***-type***" in "*scanning electron microscope-**type** particle detector*" renders the claim indefinite because it is unclear whether the limitation(s) following the phrase are part of the claimed invention or not, and the resulting claim does not clearly set forth the metes and bounds of the patent protection desired. *Ex parte Steigewald*, 131 USPQ 74.

Claim Rejections - 35 USC § 102

5. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

6. Claims 1 and 2 are rejected under 35 U.S.C. 102(b) as being clearly anticipated by Van Der Mast (USPAT 6,184,525).

► Van Der Mast discloses in Fig.1 and Fig.4 a charged particle beam (CPB) apparatus comprising a work piece vacuum chamber 12 (inherently having a background chamber pressure) for containing a work piece 14, as recited in Col.4/ll.54-65, specifically in Col.4/ll.63-65; a charged particle beam source (above axis 4 in Fig.1) as recited in Col.4, line 56; a charged particle beam optical column 2-6-8 for directing a

particle beam along an optical axis 4 toward the work piece 14, as recited in Col.4/ll.54-65; a charged particle detector 24 (Fig.1) as recited in Col.5/ll.6-8 and/or 28 (Fig.4) as recited in Col.7/ll.26-37, comprising a volume including a detector gas ionizable by the charged particles, as shown in Fig.4 and recited in Col.7/ll.26-33, electrodes to produce an electric field to cause the ionization to take place, as recited in Col.2/ll.2-16, and a detector plate 24 (Fig.1) or 28 (Fig.4) to detect signals induced in the ionized gas, as recited in Col.5/ll.6-8 and Col.7/ll.26-37, respectively, the charged particle detector including an (inherent) passage for delivery of the detector gas to maintain the pressure of the detector gas around the detector sufficient to operate the detector, while maintaining the pressure in the work piece vacuum chamber 2 at a significantly lower pressure, as recited in Col.1/ll.65-67 and Col.2/ll.1-2.

► Regarding claim 2, Van Der Mast's apparatus is a scanning electron microscope, as recited in Col.1/ll.25-26 and Col.2/ll.16-20.

7. Claims 1-20 are rejected under 35 U.S.C. 102(b) as being clearly anticipated by Suzuki et al. (USPAT 5,396,067).

Regarding independent claim 1, Suzuki et al. discloses in Fig.1 and Fig.5 a charged particle beam apparatus comprising a work piece vacuum chamber 2b (inherently having a background chamber pressure) for containing a work piece 7, as recited in Col.4/ll.4/ll.60-67 and Col.5/ll.1-11 in reference to Fig.1 and in Col.7/ll.64-68, Col.8/ll.1-68 and Col.9/ll.1-14 in reference to Fig.5; a charged particle beam source 15 as recited in Col.4/ll.60-61 in reference to Fig.1 and in Col.8/ll.37-40 in reference to

Fig.5; a charged particle beam optical column 16-17 for directing a particle beam along an optical axis (along line 3a-19a as shown in Fig.1 and (line 3a-22a as shown in Fig.5) toward the work piece 7; a charged particle detector comprising a volume shown in Fig.1 between numerals 3 and 19 in Fig.1 and 10-22 in Fig.5, including a detector gas ionizable by the charged particles and recited in Col.5/ll.6-28 in reference to Fig.1 and Col.8/ll.58-65 in reference to Fig.5, electrodes (10-19 in Fig.2 and 10-22 in Fig.5) to produce an electric field to cause the ionization to take place, as recited in Col.6/ll.34-47 in reference to Fig.2 and Col.8/ll.37-52 in reference to Fig.5, and a detector plate 10 (Figs.1 and 5) to detect signals induced in the ionized gas, the charged particle detector including an (inherent) passage for delivery of the detector gas to maintain the pressure of the detector gas around the detector sufficient to operate the detector, while maintaining the pressure in the work piece vacuum chamber 1 at a significantly lower pressure, as recited in Col.5/ll.14-19.

► Regarding claim 2, Suzuki's apparatus is a scanning electron microscope, as recited in the Abstract, line 1.

► Regarding claim 3, Suzuki's charged particle detector comprises two plates 19-10 in Fig.2 and 22-10 in Fig.5.

► Regarding claim 4, Suzuki's gas is passed into compartment 2 shown in Fig.2, i.e., automatically also between the two plates 19 and 10 in Fig.2.

► Regarding claim 5, Suzuki's apparatus comprises a nozzle 26 directing gas towards a region between detector plate 10 and work piece 7, as shown in Fig.7 and recited in Col.9/ll.33-38.

► Regarding independent claim 6, Suzuki et al. disclose in Fig.5 and Fig.6 a charged particle beam (CPB) apparatus comprising a work piece vacuum chamber 2b for containing a work piece 7 and having a background chamber pressure (that is inherent in every CPB); a charged particle beam source 15; a charged particle beam optical column 16-17 for directing a particle beam along an optical axis toward the work piece 7, as recited in Col.8/ll.37-50 and Col.8/ll.21-32; an ion generator (region 2b in Fig.5 or 26a in Fig.6) in which secondary particles generated by the impact of charged particle beam on a work piece 7 or particles from the primary beam backscattered by the work piece 7 ionize an ion producing gas, as recited in Col.5/ll.54-68, Col.6/ll.1-9 and Col.8/ll.3-20 + 44-57, the ion generator positioned such that at least some of the ions travel to work piece to neutralize charge on the work piece, as recited in Col.5/ll.46-52 + 60-68, more specifically in Col.6/ll.4-9 and Col.2/ll.6-24 + 16-19, the ion generator including a chamber (2b in Fig.5 and/or 2 in Fig.6) containing a gas, the chamber connected to the work piece vacuum chamber (2a in Fig.5 and/or numeral 2 in Fig.6) through an aperture 22a (Fig.5) or 26a (Fig.6) that allows secondary or backscattered particles from the work piece 7 to enter the chamber and allows ions to exit the chamber to neutralize charge on the work piece, as recited in Col.5/ll.46-52 + 60-68, more specifically in Col.6/ll.4-9 and Col.2/ll.6-24 + 16-19, the latter referring to Fig.9.

► Regarding claim 9, the additional limitations are specifically recited by Suzuki et al. in Col.5/ll.46-52, more specifically in Col.5/ll.60-68 with regard to a lower pressure being maintained in the background chamber 1 shown in Fig.5 and Fig.6.

► Regarding independent claim 21, the additional limitation of a gas supply is shown in Fig.6 and Fig.7 by numeral 26, which forms a channel electrode between the detector electrode 3 and the aperture opening 26a to channel secondary electrons toward a detector electrode 10 defining an inner volume 2, wherein a higher pressure than the vacuum chamber 1 is maintained by gas supply to promote gas ionization cascades, to thereby generating ions to be emitted from the inlet opening 26a and providing an amplified secondary electron signal, as expressly recited in Col.8/ll.49-57 and Col.9/ll.9-13, and more specifically in Col.2/ll.19-22.

► The above recited channel electrode and gas chamber also anticipate claim 18 that is dependent on previously rejected claim 9.

► Regarding claims 7 and 17, the limitation that the ion generator between aperture 26a or tune 26 and pump 28 is not positioned in-line with the optical axis (which is a straight line drawn from source 15 to sample 7) can be obviously seen in Fig.7.

► Regarding claim 8, the subject matter of Suzuki's disclosure is a scanning electron microscope, as recited in Col.8, line 37.

► Regarding claim 22, the channel electrode 26 is formed as part of the body of the CPB column in Fig.6 and Fig.7.

► Regarding claim 24, Suzuki's channel electrode 26 and detector electrodes 10 are electrically isolated one from another, as implicated in Fig.6 and Fig.7.

Claim Rejections - 35 USC § 103

8. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

9. Claims 10-12, 20, 23, 25 and 26 are rejected under 35 U.S.C. 103(a) as being unpatentable over Suzuki et al..

Suzuki et al. show all the limitations of claims 10-16, 20, 23, 25 and 26, as previously applied to the independent claims 6, 9 and 21, except for specific limitations to be individually addressed as follows:

► Regarding claims 10-12, Suzuki's ion producing gas pressure on the order of magnitude of 0.1 Torr, as recited in Col.1/ll.49-052 and Col.8/ll.15-20, whereas the pressure in background chamber 1 is conventionally zero, i.e., practically less than about 10^{-3} Torr.

It would have been obvious to one having ordinary skill in the art at the time the invention was made to maintain the pressure in the ion production region specifically about 0.1 Torr (claim 10), or 0.3 Torr (claim 11) or 0.4 Torr (claim 12), and further, the pressure in the background chamber 1 at less than 0.01 Torr (claim 10), or less than about 10^{-3} Torr (claims 11 and 12), since it has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art. *In re Aller*, 105 USPQ 233.

One of ordinary skill in the art would be motivated to modify Suzuki's pressure values to those claimed in claims 10-12, since it has been held that discovering an optimum value of a result effective variable involves only routine skill in the art. *In re Boesch*, 617 F.2d 272, 205 USPQ 215 (CCPA 1980).

► Claims 20 and 25 recite the limitations of claims 6, 9 and/or 21 in duplicates. The court held that mere duplication of parts has no patentable significance unless a new and unexpected result is produced. *In re Harza*, 274 F.2d 669, 124 USPQ 378 (CCPA 1960).

► Regarding claim 23, Suzuki et al. disclose the claimed invention as previously applied to claim 21, except for the limitation that the channel electrode is conical in shape.

It would have been an obvious matter of design choice to modify Suzuki's cylindrical tube-like channel electrode 26 to have a conical shape, since applicant has not disclosed that such a conical shape solves any stated problem or has any particular purpose and it appears that the invention would perform equally well with Suzuki's cylindrical tube-like channel electrode 26. Therefore, Applicant's use of conical channel electrode is a mere matter of design choice that is unpatentable, because it only involves routine skill in the art.

One of ordinary skill in the art would be motivated to shape Suzuki's channel electrode 26 in a conical form as a typical design choice, since no special skill in the art beyond the ordinary is thereby required. *In re Howard v. Detroit Stove Works*, 150 U.S. 164 (1893).

10. Claim 13-16 and 26 is rejected under 35 U.S.C. 103(a) as being unpatentable over Suzuki et al. in view of Van Der Mast.

Suzuki et al. show all the limitations of claims 13-16 and 26, as previously applied to the independent claims 9 and 21, except for specific recitations related to an environmental scanning electron microscope (ESEM) and a magnetic field structure.

► Insofar as the Examiner can ascertain beyond the indefinite term "*ESEM-**type** particle detector*" in claims 13 and 14, Van Der Mast discloses a in Figs.1, 2 and 4 a charged particle beam apparatus similar to Suzuki's SEM. Van Der Mast's charged particle detector is designed for use with an ESEM, thus belonging to the "*ESEM-type particle detector*" recited in claims 13 and 14. Van Der Mast's *ESEM-type particle detector* is recited in Col.2/ll.16-38, especially in lines 47-57, and further in Col.3/ll.42-63.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Suzuki's SEM with Van Der Mast's particle detector, which is specifically designed to operate with an ESEM, since in Van Der Mast's detector configuration the detector's multipole electric field cooperates with the magnetic filed of the immersion lens 8, thus resulting in a substantially higher electric field strengths that are capable of ionizing gas particles in a substantially shorter length and/or smaller volume, as taught by Van Der Mast in Abstract lines 10-18.

One of ordinary skill in the art would have been motivated to modify Suzuki's secondary electron detector by Van Der Mast's ESEM particle detector, since the short

ionization length is compatible with the constraint of small objective distance prevailing in an ESEM.

► Specifically regarding claim 14, Van Der Mast's *ESEM-type particle detector* shown in Fig.2 comprises a plate 30 having an aperture coaxial with the CPB, i.e., along axis 4, as recited in Col.5/ll.31-39, and further, in Col.5/ll.6-8 in reference to Fig.1 and in Col.7/ll.26-37 in reference to Fig.4.

► Regarding claim 15, Van Der Mast's CPB includes a magnetic immersion objective lens 8, as recited in the Abstract, lines 10-18, in which the detector plate 28 is positioned above a work piece 14 and below a pole of the magnetic objective lens located below the numeral 8 in Fig.1.

► Regarding claim 16, Suzuki's CPB apparatus includes a passage for transporting the ion producing gas, as recited in Col.3/ll.35-53, more specifically in Col.3/ll.44-45.

► Regarding claim 26, Van Der Mast's ESEM particle detector further comprises a controllable magnetic field generation structure proximal to the aperture opening in plate 28 shown in Fig.4 for guiding secondary electrons into the aperture opening, as recited in Col.7/ll.18-37.

Indication of Allowable Subject Matter

11. Claims 6-20 are allowed.

Reasons for Indication of Allowable Subject Matter

12. The following is a statement of reasons for the indication of allowable subject matter: *[same as Reasons for Allowance].*

Reasons for Allowance

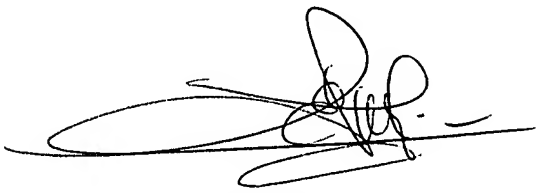
13. An electron beam apparatus and method for inspecting integrated circuits based on secondary electron emission from the irradiated target, combined with laser-assisted dry-etching process to remove residuals components and other impurity defects, wherein (a) the laser wavelength is tuned to induce high absorption in copper chloride but low absorption in copper; (b) the laser beam direction is scanned and toggled to maximize the laser-assisted etching efficiency; and (c) the etching process is watched by observing the change in contrast and *color* of the secondary electrons emitted by the inspected target (using of a multiple of wavelength/energy dispersive secondary electron detectors), are neither anticipated nor rendered obvious by any prior art.

Communications

14. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Bernard E Souw whose telephone number is 571 272 2482. The examiner can normally be reached on Monday thru Friday, 9:00 am to 5:00 pm..

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, John R Lee can be reached on 571 272 2477. The central fax phone number for the organization where this application or proceeding is assigned is (703) 872-9306 for regular communications as well as for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703 308 0956.



Bernard E. Souw

Patent Examiner – AU 2881

March 11, 2005